ascertained, and the mortality percentages thus deduced consequently utterly untrustworthy. The severest test that could be conceived for genuine criticism of M. Pasteur's method is obviously the comparison of the death-rate in his Class A. with that among persons, not his patients, proved to have been bitten by rabid dogs by the fact of at least one of those attacked by the animal dying of the disease. Such a comparison is now fortunately possible. The probability of rabies following the bite of a rabid dog is now definitely ascertained to be from 15 to 16 per cent. of those attacked.

Now the death-rate in M. Pasteur's Class C. is no more than 1·36 per cent., even including every fatal case—that is, inclusive of those persons who develop the disease during the first fifteen days after the bite. The rigid comparison of these two death-rates may well afford M. Pasteur the satisfaction of feeling that he has saved a number (to be counted by hundreds rather than tens) of his fellow-creatures from the most agonizing of deaths, and an enormous number from the worst of apprehensions.

For general biological science the next most interesting statistics are those which seem to reveal the mode of action of the curative and prophylactic inoculations. M. Pasteur's explanations of the beneficial effects of the material inoculated was that the nerve-tissue contained not only the microbes, the causative factors of the disease, but also their metabolic products, and that these latter by accumulation inhibit the growth and spread of the organisms. If, therefore, these products were injected into the blood-stream in sufficient quantity, he believed that the animal so treated would be protected from the malady. In this country Dr. Wooldridge had already proved experimentally the occurrence of such a process in the case of anthrax or splenic fever. Now the accumulated experience of M. Pasteur's laboratory goes very far to establish this theory for rabies also. Thus in Russia, where rabies is frightfully prevalent by reason of its being endemic among wild (wolves notably) as well as among domestic animals, the figures obtained from the respective inoculation stations are most striking :—

	Odessa death-rate per cent.		Moscow death-rate per cent.		Warsaw death-rate per cent.
1886. " Traitement simple " (*i.e.* small quantities injected)	3·39	...	8·40	...	3
1888. " Traitement intensif " (*i.e.* large quantities injected)	0·64	...	1·60	...	0 [1]

It is abundantly evident from these figures that successful protection is due to the energy and frequency with which inoculations are practised, or, in other words, to the quantity of protective material injected. While we cannot too heartily congratulate M. Pasteur on his triumph in finding a cure for this miserable disease, we feel very glad that, since his work has established the true nature of rabies and its mode of propagation among animals and men, the French authorities have at last awakened to the fact that there is no disease which can be more successfully prevented by legislation. M. Grancher exhibited a chart showing the immediate effect of preventive legislation in reducing the prevalence of the malady in the Department of the Seine. For us, our own experience of the measures whereby the disease was temporarily extirpated from London (though now, of course, reappearing since the relaxation of the restrictions) is so strong that we hope this additional evidence will induce our Privy Council to apply such measures throughout the country ; and having thus stamped out the disease in England, prevent by suitable contra-importation measures the re-introduction of the disease.

So much for the work of the Institute as immediately in operation. The special interest of the inauguration ceremony is noteworthy. We have already referred to it as being in part due to the personal monument it establishes to the genius of M. Pasteur, but it has a more particular interest for British national science. It lies in the fact that here we see an institution erected for the national purpose of scientific investigation into the causes of diseases and their mode of prevention. We see, moreover, the head of the Executive Government, in company with the members of his Cabinet, personally giving to the movement his cordial interest and support. It must make us all wonder when our Government will cease to regard the social and political importance of scientific investigations with other than an absolutely ineffective interest.

At present, for scientific investigations of this kind this country and its Government are positively dependent upon the charity of a private laboratory, that of the Brown Institution, the income of which, utterly inadequate, is very imperfectly helped by the defrayal on the part of the Government of simply the immediate expenses of the work done for them. And at the same time we wonder when our Government will remove the disgraceful legislative hindrances to British scientific work. Finally, we may ask, When shall we see the scientific millennium of an English Ministry taking an immediately personal interest in the welfare and support of such an institution ? We can only conclude in the spirit of the words of the *Times* with which this article begins ; and hope that, if it is generally appreciated how the lead has been taken from this country by France, at least an effort will be made by those who are responsible for the discredit thus forced on us to remove the blot by organizing a somewhat similar institution in England.

---

[1] " Intensif " treatment for last sixteen months—no death.

PRACTICAL BOTANY.

A Course of Practical Instruction in Botany. By Prof. F. O. Bower, D.Sc., F.L.S. Part I. Second Edition. (London : Macmillan and Co., 1888.)

THE first edition of Part I. of Profs. Bower and Vines's "Practical Botany" was published in 1885 (see NATURE, vol. xxxii. p. 73) ; and during the three years that have elapsed the book has become familiar in all botanical laboratories, and has proved an important aid to the work of both teachers and students. This first part deals with the Phanerogams and Pteridophytes. Part II., completing the work, appeared only last year (see NATURE, vol. xxxvii. p. 28), and thus the former part has reached a second edition while its companion volume is still a new book. In preparing the new edition, Prof. Bower has no longer had the active co-operation of Dr. Vines; though, as explained in the preface, the chapters originally contributed by the latter have been almost entirely embodied in the present work. A short account of the book as it now stands may be of service to the readers of NATURE, for as compared with the former edition it has undergone considerable rearrangement and extension. In both these respects the first three chapters, which are introductory to the study of the types, show important changes. The book begins with a list of apparatus, and of the more ordinary reagents, the mode of preparation of which is described. A more detailed list of reagents is now given in the first of the new appendices at the end of the volume.

Chapter I. deals with the making of preparations, and the adjustment of the microscope. Under both heads the directions are most practical and excellent, and cannot be too strongly commended to the attention of students. This chapter is essentially elementary; and only simple methods, such as are indispensable for all workers, are included. A very clear account of section-cutting is given, and in Fig. 1 a diagram is added in order to explain the meaning of "radial" and "tangential" sections, a point which is often puzzling to beginners. The introduction of diagrams is an important feature of the new edition. Though not very numerous (fifteen in all) they will be found a very useful help. Strictly diagrammatic figures have been used in all cases, in order that the student may not be tempted to make use of the illustrations as substitutes for the objects illustrated. The first chapter concludes with instructions on drawing from the microscope, and on measurement.

Chapter II. contains a number of "practical exercises." In the first of these the microscopic examination of the pulp of an apple serves to make the student acquainted with the general characteristics of vegetable cells.[1] The next exercise is on Spirogyra, and the third on the Fern-prothallus. A reference to the general account of the prothallus at p. 300 would here be useful to the beginner. Next comes the Beet-root, the first object of which sections have to be made. Here the chief osmotic phenomena are studied. Protoplasmic movements are illustrated by Trianea or Hydrocharis, and by Tradescantia. The last exercise (in small print) is on cell-division, as shown in the staminal hairs of Tradescantia. This, we think, would have been better omitted at this place. It is impossible in a few lines to give a satisfactory account of so complicated a process, and inaccuracies can scarcely be avoided. Thus the statement that the nuclear "fibres are ruptured in the equatorial plane" cannot be accepted in the light of our present knowledge.

The third chapter, headed "Micro-chemical Reactions," gives a series of further practical exercises of a more advanced character. These are only in part designed for the beginner, and those which he is intended to work through are indicated by a marginal line. The remaining parts of the chapter are designed to be used for purposes of reference, during the subsequent investigation of the types. The improved account of the chlorophyll-grains (p. 51) and the fuller description of vegetable oils (p. 59) may be especially noticed. Into this chapter an adequate account of the chief facts relating to the division of the cell and nucleus might perhaps have been introduced with advantage, as their satisfactory observation with the help of modern methods is by no means beyond the powers of the more advanced students.

The introductory portion of the work terminates with some useful remarks on staining, clearing, and permanent mounting (pp. 65-70).

The study of the Dicotyledonous types begins with an examination of the seed and embryo in the Bean, the Cucumber, the Sunflower, the Castor-oil plant, and the Marvel of Peru. In the reviewer's opinion it would have been better to begin at once with the seedling, as the structure of the seed cannot possibly be really understood until the reproductive organs have been investigated. This especially applies to the last example cited, namely, Mirabilis, the description of which will, we fear, be found very puzzling by the student.

The main outlines of the description of types remain as in the former edition. Only a few of the chief alterations need be mentioned. Two excellent diagrams of bundle-systems (after Reinke) are introduced at pp. 79 and 81, while the investigation of the seedling Sunflower by means of successive transverse sections is a most valuable addition to the treatment of the difficult subject of the distribution of vascular bundles. Attention may be called to the remark, on p. 96, that the work on the *young* stem of the Sunflower may with advantage be taken earlier. The structure of the stem before secondary thickening has begun must certainly be understood in order that the subsequent changes may be intelligently studied. Diagrams, after Sachs, are introduced at p. 98 to illustrate the origin of the cambium, and at pp. 100 and 102 to show the arrangement of the cells at the apex of the stem. In the account of the periderm (p. 107) the terminology has been revised, and now agrees with that of De Bary. This subject is now illustrated by diagrams. These are original, and so also are those on p. 122, by which the form of cambial cells is explained.

At p. 137, the intercellular space beneath the stoma is still called the "respiratory cavity." This term, though so generally used, is likely to mislead beginners as to the function of the stomata, and the colourless phrase, "air-chamber," seems preferable. To the account of the structure of the petiole, a description of the pulvinus in the French Bean is now added. The Holly has been substituted for the Cherry-Laurel as the type of a coriaceous bifacial leaf; while, as examples of "iso-bilateral" structure, the phyllodes of Acacia, and the leaves of *Eucalyptus globulus*, are introduced. The aquatic type of leaf is well illustrated by Hippuris, in which the sub-aërial and the submerged leaves are compared. Passing by several minor additions, the valuable new section on the fall of the leaf may be especially noted. An account of hairs and emergences has also been added, in small type.

The work on the root of Dicotyledons has been expanded, and the very clear original diagram of its transverse section, before and after secondary thickening, is likely to be of great service.

The stem of the Monocotyledons is now described in two additional types—the Hyacinth, as a bulbous plant, and Elodea, as an aquatic. The last-named plant is also used to illustrate the modifications shown by submerged leaves, while the leaf of Iris is introduced as the example, among Monocotyledons, of iso-bilateral construction. In the account of the *root* of Monocotyledons we regret that no mention is made of the exodermis or hypodermal layer. The great importance of this layer as a protective dermal structure to the older roots, especially in plants destitute of periderm, has been sufficiently shown by Olivier and others, and there seems no reason why it should any longer be ignored in elementary teaching. The exodermis is indeed mentioned (under the older, but now somewhat confusing, name of endodermis) in the new section on *aërial* roots (p. 195), but it would be a mistake to suppose that it is by any means confined to roots of this category.

---

[1] A misprint on p. 27 (line 4) may be noticed, where the word "as" has been omitted.

The work on the reproductive organs of Angiosperms has been on the whole but little altered, the naked-eye observation of various typical flowers being the most important addition. In the account of the Blue-bell (p. 203) it would perhaps be well to define the *perianth*, as beginners often fail to see that it corresponds to both calyx and corolla. The Rhododendron is introduced (p. 215) for the study of pollen-tubes. The section on the development of endosperm, and on the continuity of protoplasm between its cells, is new (p. 218).

Going on to the Gymnosperms, we find that the description of the stem of Abies now precedes that of Pinus doubtless on account of the simpler external morphology of the former. In the histological examination of the wood of Pinus we are sorry that the expression "irregularities of structure called bordered pits" has been allowed to stand (p. 230), as it does scant justice to these singularly beautiful organs. The introduction of the leaf and the root of the Yew is a great gain to this part of the anatomical investigation, while the description of the reproductive organs of the same plant is of even greater value.

Among the Pteridophyta, the chapters on Selaginella and Lycopodium have scarcely been altered. It may be pointed out that it is not quite accurate to describe the phloëm in the vascular cylinder of Lycopodium as forming a matrix (p. 268), for the true phloëm is limited to the isolated bands of tissue which alternate with the groups of xylem.

In the account of the homosporous Ferns the most important change is the introduction of Pteris for the minute structure of the vascular bundle. For this purpose it is certainly the best easily accessible type. Several useful diagrams now illustrate this chapter, among which that of the vascular skeleton of the Male Fern, will be especially welcome.

Pilularia is added as a new type, representing the heterosporous Filicineæ. It is certainly well that the student should be made acquainted with this interesting group of plants, and this addition may perhaps be regarded as the most important in the book. The relation of the vascular bundle in Pilularia to that of the true Ferns might have been made somewhat clearer if that type of bundle had been described, in which the two ends, as seen in transverse section, are not completely confluent.

Three appendices and an index have been added to this edition, the index referring to both parts of the book. Appendix I. includes reagents, and the method of preparing them. Appendix II. gives the reactions of the various substances occurring in plants: and Appendix III. is a most useful list of material, with directions for obtaining it. This last appendix is in two divisions, the second of which contains the material required for Part II. (Bryophyta—Thallophyta).

The extensive changes which this volume has undergone have rendered it more than ever an invaluable aid to the study of plants in the laboratory. English students may be congratulated on their good fortune in possessing such a hand-book, and we may confidently hope that the present edition of Prof. Bower's work may render even greater services to scientific education than did its predecessor.

D. H. S.

THE SENSES, INSTINCTS, AND INTELLIGENCE OF ANIMALS.

The Senses, Instincts, and Intelligence of Animals, with Special Reference to Insects. By Sir John Lubbock, Bart., M.P., F.R.S., D.C.L., LL.D. "International Scientific Series," Vol. LXV. (London: Kegan Paul, Trench, and Co., 1888.)

MUCH consideration of the ways of ants has imparted to Sir John Lubbock so large a measure of the wisdom of industry, that even King Solomon himself could scarcely have failed to appreciate the result. The work which has just appeared under the above title may be regarded as a sister volume to the "Ants, Bees, and Wasps," in the same scientific series. Its scope, however, is wider, and, in consequence, its subject-matter is calculated to be of even more interest to the general public, notwithstanding that "Ants, Bees, and Wasps" is already in its ninth edition.

"The Senses, Instincts, and Intelligence of Animals" runs to close upon three hundred pages, of which only about the last fifty are devoted to instincts and intelligence. The book, therefore, is primarily a treatise on the organs of special sense throughout the animal kingdom. As such, it deserves to be regarded as a valuable contribution, not only to the library of the general reader, but also to that of the working biologist. For while, on the one hand, it does not presuppose even the most elementary knowledge on the part of its readers, on the other it constitutes an excellent hand-book of reference to the principal literature on the subject. Of course, in the latter respect it is by no means exhaustive, nor does it profess to be what we understand by a text-book. Nevertheless, it will prove exceedingly useful as a book to be consulted by any naturalist who, having previously worked in other lines, may have occasion to require an index to the more important literature of sense-organs, especially of the Invertebrata. Considerably over one hundred authors are alluded to, and the essay is illustrated by 118 woodcuts, derived from the original memoirs quoted.

A considerable portion of this essay is occupied with an account of the author's own experiments on the special senses of insects, &c., together with replies to criticisms which have been advanced by high authorities in Germany and France, both as against some of his facts and some of his inferences. Without going into particulars, we may